

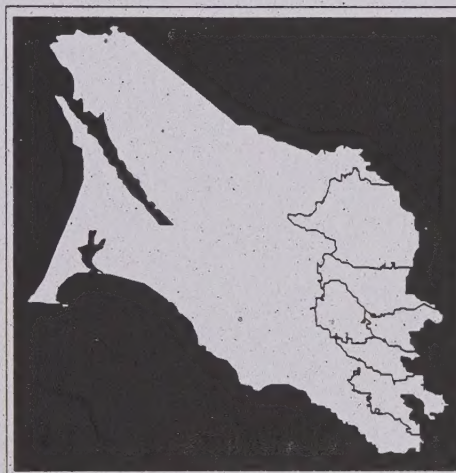
The Marin Countywide Plan

Transportation Element Technical Report #4 Transportation Impacts of the Preferred Land Use Alternative

INSTITUTE OF GOVERNMENTAL
STUDIES LIBRARY

FEB 24 1993

UNIVERSITY OF CALIFORNIA



Project Manager: Frederick E. Vogler, Principal Planner

Mark J. Riesenfeld, Planning Director

Carol Williams, Chief of Policy and Program Planning

Art Brook, Transportation Engineer

John Eells, Transportation Coordinator

Kim Hansen, Principal Planner

Thomas W. Giudice, Planner

Jane Ostermann Watts, Planner

Nancy Brooks, Secretary

The Marin County Planning Department, Civic Center, San Rafael, California

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
I. PURPOSE	2
II. AUTHORITY FOR TRANSPORTATION SYSTEMS PLANNING.....	2
III. THE TRANSPORTATION MODEL	2
IV. LAND USE SUMMARY	5
V. TRANSPORTATION MODEL ROAD NETWORK	9
VI. PROJECTED TRIP GENERATION	10
A. TRIP PRODUCTION AND ATTRACTION.....	10
B. TRIP PRODUCTION AND ATTRACTION WITHIN THE PLANNING AREAS	10
VII. PROJECTED COMMUTE TRIPS BETWEEN COUNTIES	13
VIII. PROJECTED MODE CHOICE.....	14
A. MODE CHOICE FOR MARIN TO SAN FRANCISCO TRIPS	17
B. MODE CHOICE FOR TRIPS WITHIN MARIN COUNTY	17
C. MODE CHOICE FOR SONOMA TO MARIN AND SAN FRANCISCO TRIPS	18
IX. PROJECTED ROAD CAPACITY, TRAFFIC VOLUMES, AND LEVEL OF SERVICE.....	20
A. TRANSPORTATION SYSTEM CAPACITY: HIGHWAY 101	21
B. TRANSPORTATION SYSTEM CAPACITY: LOCAL STREETS	23
C. CALIBRATION OF THE TRANSPORTATION MODEL	23
D. PROJECTED VOLUMES AND LEVEL OF SERVICE ON HIGHWAY 101	32
E. A COMPARISON WITH THE HIGHWAY 101 CORRIDOR STUDY	37
F. PROJECTED VOLUMES AND LEVEL OF SERVICE ON SELECTED ARTERIALS	38

LIST OF TABLES

1. Land Use and Demographic Inputs for Transportation Model.....	6
2. Land Use and Demographic Inputs for Transportation Model Countywide Plan Planning Areas	7
3. Trip Generation County Totals.....	11
4. Trip Generation Countywide Plan Planning Areas.....	12
5. Projected Commute Trips Between Counties: 1990, 2000, Buildout.....	15
6. Estimated Mode Split Percentages Between Counties, 1990 Home-based Work Trips.....	18
7. Estimated Mode Split Percentages Between Counties, 2000 Home-based Work Trips.....	19
8. Estimated Mode Split Percentages Between Counties, Buildout Home-based Work Trips.....	20
9. Level of Service, Volume-to-Capacity Ratios	21
10. Calculation of Highway 101 Adjustment Factors	22
11. Calculation of Capacity on Highway 101, Northbound Peak Period, 1991.....	24
12. Calculation of Capacity on Highway 101 for Northbound Peak Period, Buildout	25
13. Calculation of Arterial Street Capacity, Peak Direction, 1991	26
14. Calculation of Arterial Street Capacity Direction, Buildout.....	28
15. 1990 Transportation Model Results Compared to Traffic Counts, Highway 101	30
16. 1990 Transportation Model Results Compared to Traffic Counts, Arterials.....	32
17. Projected Level of Service and Volume-to-Capacity Ratio on Highway 101	34
18. Projected Traffic Volumes, Volume-to-Capacity Ratio, Level of Service on Highway 101, Arterials	35
19. Comparison of Studies: Highway 101 Corridor Study and The Countywide Plan	37
20. Projected Traffic Volumes, Volume-to-Capacity Ratio, Level of Service on Arterials, Buildout and 1991 Street Systems (Afternoon Peak Hour, Peak Direction)	40

EXECUTIVE SUMMARY

This technical report provides an analysis of the potential impacts of land use projections from the Community Development Element on the transportation system. To quantify these potential impacts, the Marin County Public Works Department created a transportation model. The model calculated estimates of average daily traffic volumes, morning and evening peak hour volumes and volume-to-capacity ratios for a schematic road network. The model used a projection of population, households, jobs, and other information corresponding to buildout under the current Countywide Plan and local development policies (no year was designated by which buildout is expected to occur).

The transportation system modeled with the land use projections was very similar to the Preferred Alternative of the Highway 101 Corridor Study. The system improvements include: rail transit service between Larkspur and Santa Rosa, increased bus and ferry service, High Occupancy Vehicle lanes (carpool lanes) between the Richardson Bay bridge and Sonoma County, auxiliary lanes between selected freeway interchanges, McInnis Parkway between Civic Center Drive and Rowland Boulevard, and several freeway interchange and local street improvements. Results from the Highway 101 Corridor Study had already shown that Highway 101 would suffer severe congestion between Mill Valley and Santa Rosa without the transportation improvements recommended in the Preferred Alternative. Severe congestion is defined as Level of Service F with bumper-to-bumper traffic at speeds below thirty miles an hour.

With the improvements recommended by the draft Countywide Plan, Highway 101 is projected to operate at Level of Service D or better except at Puerto Suello Hill. Here, the Level of Service borders between D and E. The Highway 101 Corridor Study and the draft Countywide Plan have established Level of Service D as a long range goal for Highway 101.

The model showed that most local streets would operate at Level of Service D or better at buildout. Local streets that would suffer Level of Service E or F include: Tiburon Boulevard near Highway 101; East Sir Francis Drake Boulevard near Andersen Drive; Sir Francis Drake Boulevard in Greenbrae and through the Upper Ross Valley; Redhill Avenue near the San Anselmo "Hub"; Bel Marin Keys Boulevard near Highway 101; most of South Novato Boulevard; Novato Boulevard and Grant Avenue west from Redwood Boulevard. The draft Countywide Plan recommends some additional traffic signals and road widening projects to alleviate most of the projected congestion. It is possible that significant environmental constraints will prevent sufficient road widening to bring the Level of Service up to D on all streets. Local governments may accept Level of Service E or F as the operating condition during the peak hours for a few streets.

The model also projected that the numbers of commuters from Marin to San Francisco would decrease while commuters within Marin and from Sonoma to Marin would increase in number. For Marin to San Francisco commutes, the model projected more transit usage and carpooling. For commutes within Marin, however, the model did not project any increase in carpooling or transit use. Sonoma residents commuting to work in Marin were projected to increase their use of carpools and transit.

I. PURPOSE

The purpose of the Transportation Impacts report is to project the potential impacts of the preferred land use alternative of the Countywide Plan on the transportation system in Marin County. Projections of travel demand for the year 2000 and buildout are compared to existing conditions, in order to determine the impacts resulting from implementation of land use policies and the system improvements needed for accommodating projected travel demand. The data contained in the report is used in the "Projections" section of the Transportation Element and the "Potential Impacts" section of the Environmental Impact Report.

II. AUTHORITY FOR TRANSPORTATION SYSTEMS PLANNING

Government Code Section 65302(b) states that the General Plan shall include "a circulation element consisting of the general location and extent of existing and proposed major thoroughfares, transportation routes, terminals, and other local public utilities and facilities, all correlated with the land use element of the plan." The Transportation Element contains objectives, policies, and implementation measures for the development and maintenance of the transportation system. The Community Facilities Element contains objectives, policies and implementation measures for public utilities and facilities.

III. THE TRANSPORTATION MODEL

The Marin County Public Works Department developed a microcomputer-based mathematical model of the transportation system in the Bay Area. The model was designed to simulate travel behavior in the Bay Area with particular emphasis on Marin, San Francisco and Sonoma Counties. Using information about land use, employment and demographic characteristics of the population, the model estimates average daily traffic volumes, morning and evening peak hour volumes, and volume-to-capacity ratios for a schematic road network.

The transportation model is a large-scale model, encompassing the entire nine-county Bay Area. Its purpose is to help traffic engineers study performance of the transportation system countywide. Because some of the worst traffic congestion occurs

on Highway 101 and its interchanges, the model was prepared primarily for analyzing Highway 101 and interchanges, not local streets. The model has not been developed in sufficient detail to answer questions about traffic within a neighborhood or the impact of small scale development such as a new office building on local streets.

The limitations of the software, the availability of data to calibrate the model and the cost per model run necessitate simplifications to the transportation system used in the model. Within Marin County, the system consists of Highways 101 and 37, Interstate 580, State Routes 1 and 131 (Tiburon Boulevard), primary arterials, selected secondary arterials, and all transit routes. The county is divided into 114 traffic zones encompassing residential neighborhoods, major employment centers and commercial areas. In San Francisco and Sonoma counties a less detailed road network is combined with fewer traffic zones. In the remaining six Bay Area counties a skeletal highway network and 24 traffic zones are used.

Given the simplifications necessary for computer modeling of traffic, it is important to remember that the results are estimates and are influenced by the configuration of the model road network and road segment capacities. The following discussion must be kept in mind when reviewing model results.

Evaluating the performance of a model requires comparing its output with actual vehicle counts on the corresponding road segments. Several factors influence the actual counts and several more influence the model-estimated counts. First, experience has shown that actual counts may vary by $\pm 10\%$ on a daily basis, with seasonal variations. For example, in most of the county, traffic is heavier from September through April. Second, traffic capacity may vary according to the physical conditions of the road. Vehicles parked at the side of the road may slow drivers, reducing traffic capacity below that expected if the road was free of parking. Capacity is significantly influenced by the number of driveways entering the road, pedestrian crossings, the number of intersections, and how traffic is regulated at intersections. The number of alternate routes may affect counts on specific segments, especially during peak commute hours. Drivers may take a "back road" to avoid a congested segment. In sum, traffic counts reflect daily and seasonal variations along with drivers' decisions about which routes are the quickest based on perceived congestion and travel speed.

Due to the simplifications necessary for modeling, the above mentioned physical and operational factors cannot be represented in the same detail. Generally, models allow the operator to assign number of lanes and "facility type" to the road segment (e.g. four lane divided arterial or two lane rural highway). Such factors as parking, driveway entrances, signalization and pedestrian activity may be accounted for by assigning a specific facility type with lower capacity.

The model estimates demand for road space based on the number of trips generated by land uses and the mode choice of trip makers (e.g. drive alone, carpool, transit). The model assigns vehicles to the network based on segment capacity and calculated vehicle speeds on the segments. After its iterations, the model reports vehicle volumes on road segments. High volume-to-capacity ratios indicate a bottleneck, but the model does not show the effects of a bottleneck on the system.

The simplified road network used in the model eliminates many roads, some of which may be alternate routes. Also, due to the simplified road network, a traffic zone often has fewer segments connecting it to the road network. Actually, many outlets from the same neighborhood may be represented by that traffic zone. Combined with the placement of the road segment connecting the traffic zone to the road network, the limit of only a few connector roads significantly influences estimated traffic of some road segments. It is the responsibility of the traffic engineer to note the discrepancies between the physical layout of real streets and their schematic representation in the model and account for these differences.

In the model, the county is divided into 114 traffic zones, each representing a census tract or a subdivision of a census tract. Generally, the zones represent areas of similar land use such as residential neighborhoods, shopping centers, or office/industrial parks. The zones were still relatively large, however, too large to be useful for small area analysis. Due to the limited connections between the zones and the simplified network, traffic volumes on arterials may differ from actual counts on certain segments.

When modeling a year in the future, a host of assumptions are made concerning inputs to the model such as population, household income, number of jobs, automobile operating costs, etc. The representation of a future described by the values of the numbers should be considered a projection. Just as the model inputs are considered projections of recent trends (with assumptions about those trends might change), the results of the modeling effort should be interpreted as a *projection*, not a prediction.

This discussion sets a context for reviewing the model results. It is important to keep in mind that the simplifications necessary for modeling may produce results that are not accurate for some road segments. This is especially true when a street has many changes along its length which cannot be represented in sufficient detail in the model.

IV. LAND USE SUMMARY

The land use and demographic information used as inputs to the transportation model include population, number of households, household size, average household income, total number of jobs, retail jobs, service jobs, "other" jobs, and employment density (number of jobs per acre). For Marin County the data was calculated from the volume of commercial and residential development allowed under existing general plans (those adopted prior to 1991). This volume of development is referred to as "buildout." There is no date associated with buildout under current general plans. Rather than stating a projection year, this report will refer to the future date as "buildout." For example, the text might state "home-based work trip productions increased by XX% between 1990 and buildout."

Housing and population information were estimated from the amount of residential development and compared with other sources such as estimates from the State Department of Finance and projections from the Association of Bay Area Governments (ABAG). The modeling exercise took place before the 1990 Census information was released. Therefore, U.S. Census information was not used for the transportation model. The Community Development Element of the Countywide Plan uses 1990 Census figures for population and households.

The Metropolitan Transportation Commission (MTC) is the source of land use information for the other eight Bay Area counties. MTC obtained most of its information from (ABAG). The model used ABAG's land use projections for the year 2010 for the other Bay Area counties. Some of the information needed for Marin County, such as average household income and household size, was also obtained from ABAG and MTC projections for the year 2010.

The County also modeled land use and transportation for the year 2000 for its Congestion Management Program. The amount of development chosen for the year 2000 was prorated between 1990 and buildout (the most recent update of the County land use databases was in the winter of 1990). Table 1 below shows the county totals for some inputs to the transportation model for 1990, 2000, and buildout. It also shows the percentage change between 1990 and buildout.

**Table 1. Land Use and Demographic Inputs for Transportation Model
County Totals: 1990, 2000 and Buildout**

Land Use and Demographic Inputs	1990	2000	Buildout	1990 to Buildout % Change
Households	96,217	105,799	115,277	19.8%
Population	222,636	243,826	259,844	16.7%
Average Household Size	2.3	2.3	2.3	0.0%
Average Household Income	38,296	45,673	40,672	6.2%
Total Jobs	104,840	125,176	145,433	38.7%
Employed Residents	132,044	145,167	155,264	17.6%

The planning areas of Novato and Las Gallinas account for a large share of household and population growth within the urban corridor. Approximately 30% of the county's new households are projected for Novato, and 15% are projected for Las Gallinas. Due to relatively larger households, these planning areas are also projected to have higher percentage increases in projected population. Novato is projected to account for 33% of the county's population increase and Las Gallinas for 26% of the increase. West Marin is projected to have a 64% increase in households, but at historical rates of growth buildout will occur in West Marin much later than in the urban corridor.

Of the approximately 40,000 additional jobs projected for the county, just over half of the increase occurs in the Novato planning area. Approximately one-quarter of the additional jobs are projected for Central San Rafael.

Countywide, approximately 23,000 new employed residents are projected between 1990 and buildout. The Novato planning area is projected to house approximately 38% of these new workers.

The county is projected to add two jobs for every new employed resident between 1990 and buildout. Although the county is projecting more new jobs than new workers, the total number of jobs at buildout remains lower than the total number of employed residents: 145,433 jobs and 155,264 employed residents. Many Marin residents will still be commuting to San Francisco and the East Bay at buildout.

Table 2 shows the inputs to the Marin Transportation Model for each of the Countywide Plan planning areas. Included in this table is the percentage change between 1990 and buildout.

**Table 2. Land Use and Demographic Inputs for Transportation Model
Countywide Plan Planning Areas, 1990, 2000, Buildout**

Estimated Households	1990	2000	Buildout	1990 to Buildout % Change
Novato	19,788	22,681	25,565	29.2%
Las Gallinas	11,348	12,785	14,208	25.2
Central San Rafael	14,553	15,766	16,969	16.6
Upper Ross Valley	10,328	10,741	11,148	7.9
Lower Ross Valley	12,307	12,901	13,483	9.6
Richardson Bay	22,592	23,898	25,195	11.5
<u>West Marin</u>	<u>5,301</u>	<u>7,007</u>	<u>8,709</u>	<u>64.3</u>
County Total	96,217	105,779	115,277	19.8%
Estimated Population	1990	2000	Buildout	1990 to Buildout % Change
Novato	53,801	59,888	65,965	22.6%
Las Gallinas	23,764	31,089	33,289	40.1
Central San Rafael	31,402	32,891	34,374	9.5
Upper Ross Valley	23,572	24,014	24,447	3.7
Lower Ross Valley	30,096	30,663	31,218	3.7
Richardson Bay	47,187	49,009	50,821	7.7
<u>West Marin</u>	<u>12,814</u>	<u>16,272</u>	<u>19,730</u>	<u>54.0</u>
County Total	222,636	243,826	259,844	16.7%
Estimated Average Household Size	1990	2000	Buildout	
Novato	2.7	2.6	2.6	
Las Gallinas	2.0	2.4	2.3	
Central San Rafael	2.2	2.1	2.0	
Upper Ross Valley	2.3	2.2	2.2	
Lower Ross Valley	2.5	2.4	2.3	
Richardson Bay	2.1	2.1	2.0	
<u>West Marin</u>	<u>2.4</u>	<u>2.3</u>	<u>2.3</u>	
County Total	2.3	2.3	2.3	

Table 2 (continued)

Estimated Average Household Income	1990	2000	Buildout	1990 to Buildout % Change
Novato	37,924	44,187	39,918	5.3%
Las Gallinas	38,354	49,249	42,291	8.9
Central San Rafael	33,840	42,903	37,984	12.2
Upper Ross Valley	34,037	40,565	36,124	6.1
Lower Ross Valley	42,642	48,638	43,203	1.0
Richardson Bay	43,727	51,952	46,424	6.2
<u>West Marin</u>	<u>26,794</u>	<u>30,813</u>	<u>30,750</u>	<u>14.8</u>
County Total	38,296	45,673	40,672	6.2%
Estimated Total Jobs	1990	2000	Buildout	1990 to Buildout % Change
Novato	18,230	30,019	41,799	129.3%
Las Gallinas	18,412	19,260	20,074	9.0
Central San Rafael	24,136	29,091	34,039	41.0
Upper Ross Valley	6,065	6,523	6,976	15.0
Lower Ross Valley	20,589	21,072	21,543	4.6
Richardson Bay	15,050	16,203	17,347	15.3
<u>West Marin</u>	<u>2,358</u>	<u>3,008</u>	<u>3,655</u>	<u>55.0</u>
County Total	104,840	125,176	145,433	38.7%
Estimated Employed Residents	1990	2000	Buildout	1990 to Buildout % Change
Novato	30,538	35,477	39,419	29.1%
Las Gallinas	16,778	19,153	20,483	22.1
Central San Rafael	18,611	20,560	21,358	14.8
Upper Ross Valley	13,687	13,822	14,033	2.5
Lower Ross Valley	15,768	16,373	16,933	7.4
Richardson Bay	29,785	30,682	31,817	6.8
<u>West Marin</u>	<u>6,877</u>	<u>9,100</u>	<u>11,221</u>	<u>63.2</u>
County Total	132,044	145,167	155,264	17.6%

V. TRANSPORTATION MODEL ROAD NETWORK

The transportation system modeled with the land use information is very similar to the preferred transportation alternative recommended by the 101 Corridor Study Committee. For the buildout projection the following additions were made to the 1990 base network:

- 1) a light rail train running between Santa Rosa and the Larkspur Ferry Terminal;
- 2) increased ferry service to San Francisco;
- 3) increased bus service with Central and Northern Marin buses routed to deliver passengers to the train;
- 4) completion of the High Occupancy Vehicle (carpool) lanes through Marin and northward to Santa Rosa; and,
- 5) auxiliary lanes between selected freeway interchanges;
- 6) McInnis Parkway between the Marin Civic Center and the Rowland Boulevard interchange at Highway 101 in Novato. (McInnis Parkway was not included in the 101 Corridor Study plan, but would only be needed and built if significant development occurred on the east side of Highway 101);
- 7) A overpass across Highway 101 in the Las Gallinas Valley Planning Area (Merrydale overcrossing) and a new northbound on ramp;
- 8) An extension of Andersen Drive from Jacoby Street to B Street in San Rafael;
- 9) Improvements to the Lucas Valley Road interchange with Highway 101;
- 10) New Park and Ride lots at Tamalpais Drive and Rowland Boulevard;

For purposes of meeting requirements of the Congestion Management Program law, the County also modeled a year 2000 scenario. The transportation system used with that model run had the more minor improvements added to the 1990 base network. These improvements included a new segment of carpool lanes between Central San Rafael and North San Pedro Road, a southbound auxiliary lane between Miller Creek Road to North San Pedro Road, the Andersen Drive extension, the Merrydale overcrossing and northbound on ramp, park and ride lots, and improvements to the Lucas Valley Road interchange with Highway 101.

There was still a gap in the High Occupancy Vehicle lanes between Sir Francis Drake Boulevard and Second Street in San Rafael. The HOV lanes stopped in Novato also, rather than continuing to Sonoma County. No transit improvements were added to the base year network.

VI. PROJECTED TRIP GENERATION

A. TRIP PRODUCTION AND ATTRACTION

Each traffic zone has land uses which either produce or attract trips. Households produce trips. Job centers, retail and service centers, and recreational facilities attract trips. The concept of trip producers and attractors applies to home-based trips. "Home-based" means that home is either an origin or destination of the trip. Non-home-based trips occur between two attractors. For modeling those trips, one attractor is assigned the role of producer.

The factors which determine trip productions and attractions for each trip type include: the number of households, persons per household, total population, average household income, total number of jobs, and retail, service, and "other" employment.

The potential impact of future development on the transportation system is first measured by trip generation, the amount of trip productions and attractions of the land uses. As shown in Table 3, the total number of trip productions increases by 18% between 1990 and buildout. Trip attractions increase by 17%. Of note is that home-based work trip attractions increase by 40%, over twice the percentage increase of all trip attractions. This is because of the 39% increase in number of jobs.

B. TRIP PRODUCTION AND ATTRACTION WITHIN THE PLANNING AREAS

The increase in the number of trips produced by a planning area is a function of an increase in the number of households and changes in household size and household income (but there is not a direct, linear relationship between changes in trip making and changes in household size and income). The Novato Planning Area was projected to have the greatest increase in trip productions and attractions. Trip productions are projected to rise from 166,000 in 1990 to 217,000 at buildout, a 31% increase. West Marin had the greatest percentage increase of trip productions and attractions among the planning areas, but this was because it produced relatively few trips in 1990.

Table 3. Trip Generation Totals: 1990, 2000 and Buildout

Trip Productions by Type	1990	2000	Buildout	1990 to Buildout % Change
Home-based Work	158,419	184,951	207,558	31.0%
Home-based Shopping	179,388	193,400	208,324	16.1
Home-based Social/Recreation	114,252	123,912	132,430	15.9
Home-based School	64,183	66,486	67,727	5.5
<u>Non-home-based</u>	<u>162,770</u>	<u>174,339</u>	<u>184,788</u>	<u>13.5</u>
TOTAL TRIPS	679,012	743,088	800,827	17.9%
Trip Attractions by Type	1990	2000	Buildout	1990 to Buildout % Change
Home-based Work	119,805	143,499	167,143	39.5%
Home-based Shopping	193,548	206,641	218,823	13.1
Home-based Social/Recreation	96,633	102,324	107,753	11.5
Home-based School	50,518	51,183	51,643	2.2
<u>Non-home-based</u>	<u>162,770</u>	<u>174,339</u>	<u>184,788</u>	<u>13.5</u>
TOTAL TRIPS	623,274	677,986	730,150	17.1%

The Novato planning area produced more trips than other planning areas at buildout and had the greatest increase in the number of trips because it is a larger part of the City-Centered Corridor than other planning areas and had the greatest growth potential. What is commonly thought of as "San Rafael" is split into two planning areas: Central San Rafael and Las Gallinas. Together these two planning areas have more households than Novato at buildout and produce more trips. The two San Rafael planning areas are also projected attract more trips than Novato at buildout due to a larger number of jobs.

The relatively high number of new trips generated by Novato, as compared to other planning areas, indicates a continuing shift towards increased traffic volumes in the northern portion of the county relative to the central and southern portions of the county.

Table 4 below shows the trip productions and attractions for each Countywide Plan planning area estimated in 1990, 2000, and buildout. Also shown is the corresponding percentage change between 1990 and buildout and the planning area's percentage of the countywide increase during the same time period.

**Table 4. Trip Generation Countywide Plan Planning Areas:
1990, 2000 and Buildout**

Trip Production	1990	2000	Buildout	1990 to Buildout % Change
Novato	165,965	192,781	217,010	30.8
Las Gallinas	88,098	96,135	102,783	16.7
Central San Rafael	107,253	116,231	123,295	15.0
Upper Ross Valley	63,903	65,911	67,198	5.2
Lower Ross Valley	84,740	86,102	87,352	3.1
Richardson Bay	135,925	142,235	148,936	9.6
<u>West Marin</u>	<u>33,128</u>	<u>43,693</u>	<u>54,253</u>	<u>63.8</u>
COUNTY TOTAL	679,012	743,088	800,827	17.9
Trip Attraction	1990	2000	Buildout	1990 to Buildout % Change
Novato	113,358	146,100	177,627	56.7
Las Gallinas	87,656	89,483	90,573	3.3
Central San Rafael	126,745	141,467	155,434	22.6
Upper Ross Valley	53,924	53,816	53,856	-0.1
Lower Ross Valley	104,562	101,755	99,401	-4.9
Richardson Bay	116,519	117,936	119,498	2.6
<u>West Marin</u>	<u>20,510</u>	<u>27,429</u>	<u>33,761</u>	<u>64.6</u>
COUNTY TOTAL	623,274	677,986	730,150	17.1

VII. PROJECTED COMMUTE TRIPS BETWEEN COUNTIES

When calculating a trip distribution for home-based work trips, the model compares the number of employed residents and jobs within a traffic zone and between traffic zones. A known trip distribution table such as the journey to work information from the 1980 U.S. Census is used as a starting point. A 1987 distribution was estimated from the 1980 Census and then compared with more recent data (e.g. data from the Golden Gate Bridge District and Metropolitan Transportation Commission). The factors used to calibrate the 1987 trip distribution were then used as a basis for projecting a future year. These factors take into account whatever variables influence trip distribution, even those not used by the model. Some of the trends which influenced trip distribution in 1980 and 1987 were carried into the projection, but the relative strength of these trends gradually diminish. The farther into the future the projection, the greater the influence of travel time is on trip distribution.

Because the number of jobs in Marin County was projected to increase faster than the number of employed residents, there were more jobs "closer to home" projected in future years. Because the travel time to the new jobs was relatively low, the model tended to shorten trip lengths, assigning workers to jobs closer to where the workers lived.

A comparison of model results between 1990, 2000 and buildout showed that an increasing number and percentage of home-based work trips originating in Marin would stay in Marin. In other words, an increasing number and percentage of Marin residents were assigned to Marin jobs. Commuting to San Francisco declined both absolutely and relatively. Commuting from Sonoma to Marin increased in absolute numbers, but a smaller percentage of Sonoma residents commuted to Marin at buildout than in 1990 or 2000.

Between 1990 and the year 2000, the projected number of home-based work trips between Marin and San Francisco increased slightly (44,202 to 49,306). As a percentage of the home-based work trips originating in Marin, trips to San Francisco declined from 31.8% to 26.2%. Between the year 2000 and buildout, the projected number of trips to San Francisco dropped to 43,555. This represented only 20.8% of commute trips originating in Marin.

Both the number and percentage of trips projected to remain within Marin were higher at the year 2000 and higher still at buildout. The number of home-based work trips rose from 101,890 in 1990 to 121,121 in the year 2000 (a 19% increase) and to 147,782 at buildout (an additional 22% increase). As a percentage of all home-based work trips, those remaining within the county rose from 57.7% to 64.5% to 70.6%.

Commuting from Sonoma to Marin was projected to increase 25% between 1990 and 2000, along with another 7% between 2000 and buildout. The number of home-based daily work trips between Sonoma and Marin rose from an estimated 18,454 in 1990 to 24,580 at buildout, with 80% of that increase projected by the year 2000. Despite this increase in absolute number of trips, the percentage of Sonoma residents projected to commute to Marin dropped from 7.7% in 1990 to 7.2% at buildout. The number and percentage of Sonoma commuters to San Francisco were also projected to decline. As with Marin County, an increasing percentage of Sonoma residents were projected to work within Sonoma County rather than commute to other counties.

Commuting from Marin to the East Bay was projected to increase 11% between 1990 and 2000 and an additional 13% between 2000 and buildout. Overall, between 1990 and buildout an additional 1,805 trips to the East Bay were generated, constituting a 25% increase. Compared to the additional 46,000 commute trips within Marin, the 1,805 additional trips to the East Bay were insignificant. At buildout, 4.3% of Marin's commute trips were to the East Bay. Marin was projected to receive an additional 1,500 trips from the East Bay between 1990 and buildout.

Table 5 shows the number of home-based work trips listed by county of origin and county of destination (consider the East Bay a "county") for the years 1990, 2000, and buildout. The second part of the table shows the percentage of each county's commute trips with destinations in another county and those with destinations in the subject county. The percentages do not total 100%, since only a portion of the nine Bay Area counties were represented.

VIII. PROJECTED MODE CHOICE

Mode choice is defined as the means a person uses to travel from one place to another. The transportation model offers four modes of travel for home-based work trips: drive alone, two-person carpool, three-person carpool, and transit. Transit includes buses, trains, and ferries. For other trips, the model assigns either automobile or transit; use with the automobile assignment having a fixed number of persons per vehicle depending on the trip type. The model determines mode choice by calculating the probability that a person will choose a particular mode over alternatives based on the "utility" derived from that mode compared to others. Utility is calculated by weighing the factors a person considers choosing between alternatives and then adding the weighted factors.

**Table 5. Projected Commute Trips Between Counties:
1990, 2000, Buildout**

Year: 1990		DESTINATION		
ORIGIN	San Francisco	Marin County	Sonoma County	East Bay
San Francisco	407,948	4,525	15	28,380
Marin County	44,202	101,890	3,665	7,186
Sonoma County	8,462	18,457	188,985	2,320
East Bay	58,177	3,836	870	1,096,520
Year: 2000		DESTINATION		
ORIGIN	San Francisco	Marin County	Sonoma County	East Bay
San Francisco	451,008	4,876	21	29,545
Marin County	49,306	121,121	5,070	7,974
Sonoma County	8,834	23,016	248,240	2,518
East Bay	64,040	4,664	1,229	1,353,082
Year: Buildout		DESTINATION		
ORIGIN	San Francisco	Marin County	Sonoma County	East Bay
San Francisco	485,478	5,474	20	32,084
Marin County	43,555	147,782	4,033	8,991
Sonoma County	5,487	24,580	307,176	2,704
East Bay	83,645	5,331	1,274	1,537,891

Table 5 (continued)

(Percentage of Area Total)

Year: 1990		DESTINATION			
ORIGIN	San Francisco	Marin County	Sonoma County	East Bay	
San Francisco	84.2	0.7	0.0	6.0	
Marin County	31.8	57.7	2.3	5.3	
Sonoma County	4.9	7.7	84.9	1.3	
East Bay	5.1	0.2	0.1	88.0	
Year: 2000		DESTINATION			
ORIGIN	San Francisco	Marin County	Sonoma County	East Bay	
San Francisco	84.5	0.9	0.0	5.5	
Marin County	26.2	64.5	2.7	4.2	
Sonoma County	3.1	8.1	86.9	0.9	
East Bay	4.2	0.3	0.1	89.4	
Year: Buildout		DESTINATION			
ORIGIN	San Francisco	Marin County	Sonoma County	East Bay	
San Francisco	84.3	1.0	0.0	5.6	
Marin County	20.8	70.6	1.9	4.3	
Sonoma County	1.6	7.2	89.3	0.8	
East Bay	4.8	0.3	0.1	88.2	

The mode choice component of the model was developed by the Metropolitan Transportation Commission (MTC). All local governments which would like to receive State and Federal funds passed through MTC are encouraged to use this set of equations. MTC's mode choice model calculates the probability that an average daily person trip will be made by each mode.

The relative percentage of trips made in each mode is called the "mode split." For example, the mode split between Marin County and San Francisco estimated in 1990 was 56.3% drive alone, 19.7% two-person carpool, 8.0% three-person carpool and 16.0% transit. When transportation engineers speak of "improving the mode split" they refer to increasing the percentage of trips made in carpools or transit (and decreasing the percentage of trips in drive alone mode). This is referred to as an "improvement" because shifting trips to carpools and transit reduces the number of vehicles on the roads, thus helping to relieve congestion during the peak commute hour. When looking at changes in the mode split over time, transportation engineers may say that the mode split "improves" or "worsens" depending on the shift towards or away from drive alone mode.

A. MODE CHOICE FOR MARIN TO SAN FRANCISCO TRIPS

For home-based work trips between Marin and San Francisco, the mode split worsened between 1990 and 2000. The drive alone mode increased from 56% to 64% while transit use decreased from 16% to 13%. This was primarily due to no improvements in transit service, resulting in longer travel times relative to the automobile. Increasing household incomes also tended to shift person trips to the drive alone mode and away from transit. The estimated mode split improved between the year 2000 and buildout. The drive alone mode declined from 64% to 44% and transit use increased from 13% to 26%. During this time period significant improvements in transit service provided more competitive travel times compared to the automobile, enough of an improvement to offset the effects of increasing household income (and its tendency to shift trips to the drive alone mode). Unlike transit, carpooling to San Francisco had a more modest shift between 1990 and buildout. The percentage of two-person carpools remained at 20%. The percentage of three-person carpools rose from 8% to 10.5%.

B. MODE CHOICE FOR TRIPS WITHIN MARIN COUNTY

For home-based work trips within Marin no change was projected between 1990 and buildout. The percentage of drive alone trips rose from 88% in 1990 to 91% in 2000 but then declined to 88% at buildout. The percentage of transit trips declined from 1.1% in 1990 to 0.6% in 2000, but rose to 1.9% at buildout. Between 1990 and buildout the percentage of two-person carpools decreased to 7.3% from 8.2% and the percentage of three-person carpools remained the same at 2.5%.

C. MODE CHOICE FOR SONOMA TO MARIN AND SAN FRANCISCO TRIPS

For Sonoma to Marin commutes projected mode split improved somewhat between 1990 and buildout. The percentage of drive alone trips dropped to 50% from 62%. Two-person carpools increased from 25% to 28% and three-person carpools increased to 18% from 12%. The percentage of transit trips increased to 4.7% from 1.1%.

For Sonoma County to San Francisco commutes, the mode split was projected to improve also. The percentage of drive alone trips was projected to drop sharply from 57% in 1990 to 29% at buildout. Two-person carpools attracted 18% of the trips, up from 14%. Three-person carpools attracted 20% of the trips, up from 10%. The percentage of trips in transit was projected to increase to 33% from 19%. Tables 6, 7 and 8 show the percent of home-based work trips (average daily trips) among San Francisco, Marin, and Sonoma Counties according to mode for each year 1990, 2000 and buildout.

**Table 6. Estimated Mode Split Percentages Between Counties, 1990
Home-based Work Trips (average daily trips)**

	San Francisco	Marin	Sonoma
San Francisco			
Drive Alone	42.6	66.7	0.0
Two-person Carpool	8.9	12.8	100.0
Three-person Carpool	3.0	5.3	0.0
<u>Transit</u>	<u>45.5</u>	<u>15.2</u>	<u>0.0</u>
TOTAL	100.0	100.0	100.0
Marin			
Drive Alone	56.3	88.2	76.5
Two-person Carpool	19.7	8.2	17.4
Three-person Carpool	8.0	2.5	5.1
<u>Transit</u>	<u>16.0</u>	<u>1.1</u>	<u>1.0</u>
TOTAL	100.0	100.0	100.0
Sonoma			
Drive Alone	56.8	61.8	83.0
Two-person Carpool	14.0	24.7	12.2
Three-person Carpool	9.8	12.4	3.6
<u>Transit</u>	<u>19.4</u>	<u>1.1</u>	<u>1.2</u>
TOTAL	100.0	100.0	100.0

Table 7. Estimated Mode Split Percentages Between Counties, 2000
Home-based Work Trips (average daily trips)

	San Francisco	Marin	Sonoma
San Francisco			
Drive Alone	47.8	73.5	0.0
Two-person Carpool	8.3	9.9	100.0
Three-person Carpool	2.8	4.0	0.0
<u>Transit</u>	<u>41.1</u>	<u>12.6</u>	<u>0.0</u>
TOTAL	100.0	100.0	100.0
Marin			
Drive Alone	63.8	91.1	80.8
Two-person Carpool	17.0	6.4	14.5
Three-person Carpool	6.6	1.9	4.0
<u>Transit</u>	<u>12.6</u>	<u>0.6</u>	<u>0.7</u>
TOTAL	100.0	100.0	100.0
Sonoma			
Drive Alone	62.1	64.7	83.0
Two-person Carpool	13.2	23.2	12.1
Three-person Carpool	8.3	11.1	3.5
<u>Transit</u>	<u>16.4</u>	<u>1.0</u>	<u>1.4</u>
TOTAL	100.0	100.0	100.0

**Table 8. Estimated Mode Split Percentages Between Counties, Buildout
Home-based Work Trips (average daily trips)**

	San Francisco	Marin	Sonoma
San Francisco			
Drive Alone	43.4	55.4	0.0
Two-person Carpool	8.4	10.3	100.0
Three-person Carpool	3.1	4.8	0.0
<u>Transit</u>	<u>45.1</u>	<u>29.5</u>	<u>0.0</u>
TOTAL	100.0	100.0	100.0
Marin			
Drive Alone	44.1	88.3	68.5
Two-person Carpool	19.6	7.3	19.0
Three-person Carpool	10.5	2.5	7.3
<u>Transit</u>	<u>25.8</u>	<u>1.9</u>	<u>5.2</u>
TOTAL	100.0	100.0	100.0
Sonoma			
Drive Alone	28.5	49.6	77.7
Two-person Carpool	18.4	28.0	13.1
Three-person Carpool	20.2	17.7	4.4
<u>Transit</u>	<u>32.9</u>	<u>4.7</u>	<u>4.8</u>
TOTAL	100.0	100.0	100.0

IX. PROJECTED ROAD CAPACITY, TRAFFIC VOLUMES, AND LEVEL OF SERVICE

With a road system of a given capacity, the volume-to-capacity ratio is the primary indicator of the transportation system's performance. Volume-to-capacity is a measure of demand and supply: the number of vehicles assigned to a segment divided by the vehicular capacity of that segment. For example, if the assigned volume is 1,500 vehicles and the segment capacity is 2,000 vehicles, the volume-to-capacity ratio is 0.75. This ratio is converted to a letter grade called Level of Service. The letter grades range from A to F with A representing excellent travel conditions and F representing severe congestion. Table 9 shows the relationship between Level of Service grades and volume-to-capacity ratios.

Table 9. Level of Service, Volume-to-Capacity Ratios

	Level of Service	Volume-to-Capacity Ratio
<i>For Freeways:</i>	A	0.00 - 0.35
	B	0.36 - 0.54
	C	0.55 - 0.77
	D	0.78 - 0.93
	E	0.94 - 1.00
	F	1.00+

Source: Transportation Research Board, *Highway Capacity Manual*, Chapter 3

	Level of Service	Volume-to-Capacity Ratio
<i>For Local Streets:</i>	A	0.00 - 0.60
	B	0.61 - 0.70
	C	0.71 - 0.80
	D	0.81 - 0.90
	E	0.91 - 1.00
	F	1.00+

Source: Transportation Research Board, *Circular 212*

A. TRANSPORTATION SYSTEM CAPACITY: HIGHWAY 101

The capacity of a typical standard freeway lane is 2,000 vehicles per hour. For the purpose of this analysis, the standard capacity is reduced for those locations where lane width is less than 12 feet and where the roadway grade changes significantly. The procedures for adjusting from the standard capacity are given in the Highway Capacity Manual. Adjustment factors for several points along Highway 101 are shown on Table 10.

A second adjustment to the capacity of a standard freeway lane is provided for High Occupancy Vehicle (HOV) lanes and auxiliary lanes. The vehicle capacity of these lanes is assumed to be half of the capacity of a standard freeway lane. This assumption is based on the historic use of these kind of lanes rather than on their actual physical dimensions. Typically, these lanes rarely carry more than about 1,000 vehicles per hour. (Caltrans surveys indicate that HOV lanes carry more people than other lanes, yet are used by fewer vehicles.)

Table 10. Calculation of Highway 101 Adjustment Factors

Highway 101 Location	Adjustment For:	Factor
Golden Gate Bridge	Lane Width (Table 3-2) 10 ft @ > 6' Clear.	0.89
Sausalito Lateral to Spencer	Lane Width (Table 3-2) 11 ft @ > 6' Clear. 0.96 Grade - Table 3-4 thru 3-9 Assume - Trucks+Buses+RVs = 2% Grade - 6% for 1/2-3/4 mile Passenger Car Equivalents = 11 0.83	
Alto Hill (Between Mill Valley and Corte Madera)	Grade - Table 3-4 thru 3-9 Assume - Trucks+Buses+RVs = 2% Grade - 5% for 1/4-1/2 mile Passenger Car Equivalents = 8 0.88	
Cal Park Hill (Between Sir Francis Drake Boulevard. and Interstate 580)	Grade - Table 3-4 thru 3-9 Assume - Trucks+Buses+RVs = 2% Grade - 2% for 1/2 - 1 mile Passenger Car Equivalents = 8 0.93	
Puerto Suello Hill (Between Mission Avenue and Lincoln Avenue)	Grade - Table 3-4 thru 3-9 Assume - Trucks+Buses+RVs = 2% Grade - 5% for 1/2 - 1 mile Passenger Car Equivalents = 12 0.82	
Pacheco Hill (Between Miller Creek Road and Alameda del Prado)	Grade - Table 3-4 thru 3-9 Assume - Trucks+Buses+RVs = 2% Grade - 2% for 1/2 mile Passenger Car Equivalents = 8 0.93	

Source: Highway Capacity Manual, 1985

The total capacity of the freeway for each of the segments between the Golden Gate Bridge and the Sonoma County line is shown in Tables 11 and 12 for 1991 and buildout conditions. The buildout plan for Highway 101 includes a completed HOV lane system from the Richardson Bay Bridge to the Sonoma County Line and several sections of new auxiliary lanes.

B. TRANSPORTATION SYSTEM CAPACITY: LOCAL STREETS

The one hour capacity of an arterial street is dependent upon the same factors described above, with regard to the speed of traffic. The capacity of arterials is, therefore, greatly variable among the various kinds of streets found in Marin County. For the purpose of this analysis arterial lane capacity has been set at average values, resulting in existing volume-to-capacity ratios and service levels which are consistent with the more detailed Level of Service analysis calculated for street intersections. The hourly capacity for arterials is assumed to be 1,000 vehicles per lane for divided streets and 800 vehicles per lane for undivided streets. In addition, a capacity is established for a category of roadway located in those areas with limited intersections and driveways. This type of undivided road is assumed to have a capacity of 1,000 vehicles per lane. The one hour peak direction capacity of several selected arterial segments is shown in Table 13 for existing conditions and in Table 14 for the buildout street system as recommended in the Countywide Plan.

On all of the tables where arterial traffic data is given, two sets of parallel streets are shown as a single arterial. This is done because the model is not sufficiently detailed to accurately distinguish between closely spaced parallel streets. The two sets of streets treated as a single facility are the combination of Sir Francis Drake and Center Boulevards, from the San Anselmo "Hub" to Fairfax and Novato Boulevard, combined with Center Road from Diablo to Wilson Avenues.

C. CALIBRATION OF THE TRANSPORTATION MODEL

To ensure that the model was operating properly, several runs of the model were made for dates when actual observed traffic counts could be compared with the results from the model. Model runs were made for 1980, 1987, and 1990. The output from the 1990 model run for Highway 101 segments was compared to the 1987/91 traffic counts as shown in Table 15. The model was generally within the accepted standard for computer models, plus or minus 15% from observed data, for most points along Highway 101. Overall, the model appears to be able to simulate traffic flow on Highway 101 within a reasonable level of accuracy.

**Table 11. Calculation of Capacity on Highway 101,
Northbound Peak Period, 1991**

Highway 101 Location	# of Mixed Flow Lanes	Capacity per Lane	Mixed Flow Capacity	# of HOV/Aux. Lanes	Capacity per Lane	HOV/Aux Capacity	Total Capacity
*Golden Gate Bridge	4	1780	7120	0			7120
*Sausalito Lateral to Spencer Avenue	4	1594	6374	0			6374
Marin City to State Route 1	4	2000	8000	1	1000	1000	9000
Richardson Bay Bridge	3	2000	6000	2	1000	2000	8000
Seminary Drive to Tiburon Boulevard	3	2000	6000	2	1000	2000	8000
*Alto Hill	3	1760	5280	2	880	1760	7040
Tamalpais Drive to Lucky Drive	3	2000	6000	1	1000	1000	7000
*Cal Park Hill	3	1860	5580	0			5580
Interstate 580 to 2nd Street	3	2000	6000	1	1000	1000	7000
*Mission Avenue to Lincoln Avenue	4	1640	6560	0			6560
*Puerto Suello Hill	4	1640	6560	1	820	820	7380
North San Pedro Road to Manuel Freitas	3	2000	6000	2	1000	2000	8000
Manuel Freitas to Lucas Valley Road	3	2000	6000	2	1000	2000	8000
Lucas Valley Road to Miller Creek	3	2000	6000	2	1000	2000	8000
*Pacheco Hill	3	1860	5580	2	930	1860	7440
Alameda Del Prado to Ignacio Boulevard	3	2000	6000	1	1000	1000	7000
Ignacio Boulevard to Highway 37	3	2000	6000	1	1000	1000	7000
Highway 37 to Rowland Boulevard	3	2000	6000	0			6000
Rowland Boulevard to DeLong Avenue	3	2000	6000	0			6000
DeLong Avenue to Atherton Avenue	3	2000	6000	0			6000
Atherton Avenue to Sonoma County Line	2	2000	4000	0			4000

Notes: Capacity of the HOV and Auxiliary Lanes Assumed to Equal 50% of the Capacity of a Mixed Flow Lane.

* Capacity at these points adjusted to account for narrow lanes and/or roadway grade. See "Calculation of Highway 101 Adjustment Factors" table.

**Table 12. Calculation of Capacity on Highway 101 for
Northbound Peak Period, Buildout**

Hwy 101 Location	Mixed Flow Lanes	Capacity per Lane	Mixed Flow Capacity	HOV/Aux Lanes	Capacity per Lane	HOV/Aux Capacity	Total Capacity
*Golden Gate Bridge	4	1780	7120	0			7120
*Sausalito Lateral to Spencer Avenue	4	1594	6374	0			6374
Marin City to State Route 1	4	2000	8000	1	1000	1000	9000
Richardson Bay Bridge	3	2000	6000	2	1000	2000	8000
Seminary Drive to Tiburon Boulevard	3	2000	6000	2	1000	2000	8000
*Alto Hill	3	1760	5280	2	880	1760	7040
Tamalpais Drive to Lucky Drive	3	2000	6000	1	1000	1000	7000
*Cal Park Hill	3	1860	5580	2	930	1860	7440
Interstate 580 to 2nd Street	3	2000	6000	2	1000	2000	8000
*Mission Avenue to Lincoln Avenue	3	1640	4920	2	820	1640	6560
*Puerto Suello Hill	3	1640	4920	3	820	2460	7380
North San Pedro Road to Manuel Freitas	3	2000	6000	2	1000	2000	8000
Manuel Freitas to Lucas Valley Road	3	2000	6000	2	1000	2000	8000
Lucas Valley Road to Miller Creek	3	2000	6000	2	1000	2000	8000
*Pacheco Hill	3	1860	5580	2	930	1860	7440
Alameda Del Prado to Ignacio Boulevard	3	2000	6000	1	1000	1000	7000
Ignacio Boulevard to Highway 37	3	2000	6000	1	1000	1000	7000
Highway 37 to Rowland Boulevard	3	2000	6000	1	1000	1000	7000
Rowland Boulevard to DeLong Avenue	3	2000	6000	1	1000	1000	7000
DeLong Avenue to Atherton Avenue	3	2000	6000	1	1000	1000	7000
Atherton Avenue to Sonoma County Line	2	2000	4000	1	1000	1000	5000

Notes: Capacity of the HOV and Auxiliary Lanes Assumed to Equal 50% of the capacity of a Mixed Flow Lane.

* Capacity at these points adjusted to account for narrow lanes and/or roadway grade. See "Calculation of Highway 101 Adjustment Factors" table.

Table 13. Calculation of Arterial Street Capacity, Peak Direction, 1991

Street and Location	Facility Type	Capacity per Lane	# of Lanes	Total Capacity
Bridgeway Boulevard, Spring Street to Nevada Street	Divided Arterial	1000	2	2000
Shoreline Highway, Tennessee Valley Road to Almonte Boulevard	Undivided Arterial	800	2	1600
Almonte Boulevard, Shoreline Highway to Miller Avenue	Undivided Arterial	800	1	800
Miller Avenue, Camino Alto to Montford Avenue	Divided Arterial	1000	2	2000
Blithedale Avenue, Lomita Drive to Camino Alto	Divided Arterial	1000	3	3000
Blithedale Avenue, Elm Avenue to Carmelita Avenue	Undivided Arterial	800	1	800
Tiburon Boulevard, Highway 101 to Frontage Road	Divided Arterial	1000	2	2000
Tiburon Boulevard, Rock Hill Drive to San Rafael Avenue	Undivided Road	1000	1	1000
Paradise Drive, San Clemente Drive to Prince Royal Drive	Divided Arterial	1000	2	2000
Tamalpais Drive, Chapman Drive to Redwood Avenue	Undivided Arterial	800	1	800
Magnolia Avenue, Frances Avenue to Estelle Avenue	Undivided Arterial	800	2	1600
Bon Air Road, South Eliseo Drive to Sir Francis Drake	Undivided Arterial	800	1	800
East Sir Francis Drake, Larkspur Landing Circle to Andersen Drive	Undivided Road	1000	1	1000
Sir Francis Drake, Eliseo Drive to La Cuesta Drive	Divided Arterial	1000	2	2000
Sir Francis Drake, Bon Air Road to Wolfe Grade	Divided Arterial	1000	2	2000
Sir Francis Drake, College Avenue to Laurel Avenue	Divided Arterial	1000	2	2000
Sir Francis Drake/Center Boulevard, West of the "Hub"	Undivided Arterial	800	3	2400
Sir Francis Drake/Center Boulevard, West of Pastori	Undivided Arterial	800	2	1600
Sir Francis Drake, East of Oak Manor Drive	Undivided Arterial	800	1	800
Redhill Avenue, East of the "Hub"	Divided Arterial	1000	2	2000
Point San Pedro Road, West of Marina Way	Divided Arterial	1000	2	2000
North San Pedro Road, East of Civic Center Drive	Undivided Arterial	800	2	1600
Manuel Freitas Parkway, Las Gallinas Avenue to Las Pavadas Avenue	Divided Arterial	1000	2	2000
Lucas Valley Road, Highway 101 to Las Gallinas Avenue	Undivided Road	1000	1	1000
Lucas Valley Road, Miller Creek Road to Mt. Lassen Drive	Undivided Road	1000	1	1000

**Calculation of Arterial Street Capacity, Peak Direction, 1991
(continued)**

Street and Location	Facility Type	Capacity per Lane	# of Lanes	Total Capacity
Bel Marin Keys Boulevard, Nave Drive to Commercial Boulevard	Undivided Arterial	800	2	1600
Ignacio Boulevard, Entrada Drive to San Jose Boulevard	Divided Arterial	1000	2	2000
South Novato Boulevard, Redwood Boulevard to Midway Boulevard	Undivided Arterial	800	1	800
South Novato Boulevard, Rowland Boulevard to Arthur Street	Undivided Arterial	800	1	800
Novato Boulevard/Center Road, Diablo Avenue to Tamalpais Avenue	Undivided Arterial	800	2	1600
Novato Boulevard, San Miguel Way to San Marin Drive	Undivided Arterial	800	1	800
Grant Avenue, 5th to 7th Streets	Undivided Arterial	800	1	800
DeLong Avenue, Sherman Avenue to Redwood Boulevard	Divided Arterial	1000	2	2000
Redwood Boulevard, DeLong Avenue to Grant Avenue	Divided Arterial	1000	2	2000
Olive Avenue, Redwood Boulevard to Chase Street	Undivided Arterial	800	1	800
San Marin Drive, Redwood Boulevard to Simmons Lane	Undivided Road	1000	1	1000
Atherton Avenue, Highway 101 to Bugeia Lane	Undivided Road	1000	1	1000
Highway 37, Highway 101 to Atherton Avenue	Freeway	2000	2	4000
Highway 37, Atherton Avenue to County Line	Freeway	2000	2	4000

Table 14. Calculation of Arterial Street Capacity Peak Direction, Buildout

Street and Location	Facility Type	Capacity per Lane	Lanes	Total Capacity
Bridgeway Boulevard, Spring Street to Nevada Street	Divided Arterial	1000	2	2000
Shoreline Highway, Tennessee Valley Road to Almonte Boulevard	Undivided Arterial	800	2	1600
Almonte Boulevard, Shoreline Highway to Miller Avenue	Undivided Arterial	800	1	800
Miller Avenue, Camino Alto to Montford Avenue	Divided Arterial	1000	2	2000
Blithedale Avenue, Lomita Drive to Camino Alto	Divided Arterial	1000	3	3000
Blithedale Avenue, Elm Avenue to Carmelita Avenue	Undivided Arterial	800	1	800
Tiburon Boulevard, Highway 101 to Frontage Road	Divided Arterial	1000	3	3000
Tiburon Boulevard, Rock Hill Drive to San Rafael Avenue	Undivided Road	1000	1	1000
Paradise Drive, San Clemente Drive to Prince Royal Drive	Divided Arterial	1000	2	2000
Tamalpais Drive, Chapman Drive to Redwood Avenue	Undivided Arterial	800	1	800
Magnolia Avenue, Frances Avenue to Estelle Avenue	Undivided Arterial	800	2	1600
Bon Air Road, South Eliseo Drive to Sir Francis Drake	Undivided Arterial	800	1	800
East Sir Francis Drake, Larkspur Landing Circle to Andersen Drive	Undivided Road	1000	1	1000
Sir Francis Drake, Eliseo Drive to La Cuesta Drive	Divided Arterial	1000	2	2000
Sir Francis Drake, Bon Air Road to Wolfe Grade	Divided Arterial	1000	2	2000
Sir Francis Drake, College Avenue to Laurel Avenue	Divided Arterial	1000	2	2000
Sir Francis Drake/Center Boulevard, West of the Hub	Undivided Arterial	800	3	2400
Sir Francis Drake/Center Boulevard, West of Pastori	Undivided Arterial	800	2	1600
Sir Francis Drake, East of Oak Manor Drive	Undivided Arterial	800	1	800
Redhill Avenue, East of the Hub	Divided Arterial	1000	2	2000
Point San Pedro Road, West of Marina Way	Divided Arterial	1000	2	2000
North San Pedro Road, East of Civic Center Drive	Undivided Arterial	800	2	1600
Manuel Freitas Parkway, Las Gallinas Avenue to Las Pavadas Avenue	Divided Arterial	1000	2	2000
Lucas Valley Road, Highway 101 to Las Gallinas Avenue	Undivided Road	1000	1	1000
Lucas Valley Road, Miller Creek Road to Mt. Lassen Drive	Undivided Road	1000	1	1000
McInnis Drive, Smith Ranch Road to St. Vincents Drive	Undivided Arterial	800	1	800

**Table 14. Calculation of Arterial Street Capacity Peak Direction, Buildout
(continued)**

Street and Location	Facility Type	Capacity per Lane	Lanes	Total Capacity
Ignacio Boulevard, Entrada Drive to San Jose Boulevard	Divided Arterial	1000	2	2000
South Novato Boulevard, Redwood Boulevard to Midway Boulevard	Undivided Arterial	1000	2	2000
South Novato Boulevard, Rowland Boulevard to Arthur Street	Divided Arterial	1000	2	2000
Novato Boulevard/Center Road, Diablo Avenue to Tamalpais Avenue	Undivided Arterial	800	2	1600
Novato Boulevard, San Miguel Way to San Marin Drive	Undivided Arterial	800	1	800
Grant Avenue, 5th to 7th Streets	Undivided Arterial	800	1	800
DeLong Avenue, Sherman Avenue to Redwood Boulevard	Divided Arterial	1000	2	2000
Redwood Boulevard, DeLong Avenue to Grant Avenue	Divided Arterial	1000	2	2000
Olive Avenue, Redwood Boulevard to Chase Street	Undivided Arterial	800	1	800
San Marin Drive, Redwood Boulevard to Simmons Lane	Undivided Road	1000	1	1000
Atherton Avenue, Highway 101 to Bugeia Lane	Undivided Road	1000	1	1000
McInnis Drive, Hamilton Drive to Bel Marin Keys Boulevard	Divided Arterial	1000	2	2000
McInnis Drive, Bel Marin Keys Boulevard to Highway 37	Divided Arterial	1000	2	2000
Highway 37, Highway 101 to Atherton Avenue	Freeway	2000	2	4000
Highway 37, Atherton Avenue to County Line	Freeway	2000	2	4000

Table 15. 1990 Transportation Model Results Compared to Traffic Counts, Highway 101
Total Vehicle Trips, Afternoon Peak Hour, Peak Direction

Highway 101 Location	1990 Model Volume	1987/91 Traffic Counts	Model As % of Counts	1991 Capacity	1990 Model V/C	LOS	1987/91 Counts V/C	LOS
*Golden Gate Bridge	6386	6242	102.30 %	7120	0.9	D	0.88	D
*Sausalito Lateral to Spencer Avenue	5817			6374	0.91	D	0	N/A
Marin City to State Route 1	6623			9000	0.74	C	0	N/A
Richardson Bay Bridge	6114	6223	98.20 %	8000	0.76	C	0.78	D
Seminary Drive to Tiburon Boulevard	5885			8000	0.74	C	0	N/A
*Alto Hill	5696	6506	87.50 %	7040	0.81	D	0.92	D
Tamalpais Drive to Lucky Drive	5874	5772	101.80 %	7000	0.84	D	0.82	D
*Cal Park Hill	6582	6130	107.40 %	5580	1.18	F	1.1	F
Interstate 580 to 2nd Street	7616			7000	1.09	F	0	N/A
*Mission Avenue to Lincoln Avenue	6623			6560	1.01	F	0	N/A
*Puerto Suello Hill	7485	6414	116.70 %	7380	1.01	F	0.87	D
North San Pedro Road to Manuel Freitas	7152			8000	0.89	D	0	N/A
Manuel Freitas to Lucas Valley Road	6846			8000	0.86	D	0	N/A
Lucas Valley Road to Miller Creek	6789			8000	0.85	D	0	N/A
*Pacheco Hill	7001	6706	104.40 %	7440	0.94	E	0.9	D
Alameda Del Prado to Ignacio Boulevard	6278			7000	0.9	D	0	N/A
Ignacio Boulevard to Highway 37	5996			7000	0.86	D	0	N/A
Highway 37 to Rowland Boulevard	4733	5484	86.30 %	6000	0.79	D	0.91	D
Rowland Boulevard to DeLong Avenue	3864			6000	0.64	C	0	N/A
DeLong Avenue to Atherton Avenue	3011			6000	0.5	B	0	N/A
Atherton Avenue to Sonoma County Line	2630	4039	65.10 %	4000	0.66	C	1.01	F

* denotes screenlines for Highway 101

Highway 101 "System" Totals:

					V/C	LOS	V/C	LOS
Screenlines	35780	36037	99.30 %	38560	0.93	D/E	0.93	D/E

The model appears to be significantly below observed data at the Sonoma County line (-35%) and slightly high at Puerto Suello Hill (+17%). Therefore, at the Sonoma County line, and to a lesser extent at Puerto Suello Hill, the estimates from the model needed to be adjusted. Adjustments to model results were made in this analysis using the relationship of the model results to actual counts. (It is typical that analysis of the output from computer models is subject to the professional judgment of transportation planners who use computer models for transportation impact analysis.) The two points at which the model differed by more than 15% percent were revised to within 15% of the counts. The adjustment factor for Puerto Suello Hill is .98. The adjustment factor for the Sonoma County line is 1.31.

Similar comparisons were made for selected arterials. At five arterial segments, the model estimates were more than 15% lower than recent counts. As with freeway screenlines, the model estimates for these segments needed to be adjusted. The arterial segments and their corresponding adjustment factors are:

East Sir Francis Drake, west of Andersen Drive:	1.31
Redhill Avenue, east of the San Anselmo "Hub":	1.15
Bel Marin Keys Boulevard from Nave Drive to Commercial Boulevard:	1.13
DeLong Avenue from Sherman to Redwood:	1.17
Redwood Boulevard from DeLong Avenue to Grant Avenue:	1.39

Model estimates, corresponding counts, and segment capacities for arterials are shown in Table 16.

D. PROJECTED VOLUMES AND LEVEL OF SERVICE ON HIGHWAY 101

Due to increased capacity at critical points and reduced vehicle travel to San Francisco, conditions on Highway 101 were projected to be better at buildout than in 1991. Among the screenlines, only Puerto Suello Hill shows a lower Level of Service at buildout than it does in 1991. Other screenlines have improved Level of Service. Table 17 summarizes the results of the modeling exercise. Shown are Level of Service and volume-to-capacity ratios at each screenline for existing conditions and buildout.

Table 16. 1990 Transportation Model Results Compared to Traffic Counts, Arterials
Total Vehicle Trips, Afternoon Peak Hour, Peak Direction

Street and Location	1990 Model Volume	1987/91 Traffic Counts	Model As % of Counts	1987/91 Traffic Capacity	V/C	LOS
Bridgeway Boulevard, Spring Street to Nevada Street	862	904	95.40%	2000	0.45	A
*Shoreline Highway, Tennessee Valley Road to Almonte Boulevard	1073	1147	93.50%	1600	0.72	C
*Almonte Boulevard, Shoreline Highway to Miller Avenue	552	655	84.30%	800	0.82	D
Miller Avenue, Camino Alto to Montford Avenue	1013	1016	99.70%	2000	0.51	A
Blithedale Avenue, Lomita Drive to Camino Alto	1821	1679	108.50%	3000	0.56	A
Blithedale Avenue, Elm Avenue to Carmelita Avenue	634	656	96.60%	800	0.82	D
*Tiburon Boulevard, Highway 101 to Frontage Road	1802	1665	108.20%	2000	0.83	D
Tiburon Boulevard, Rock Hill Drive to San Rafael Avenue	791	800	98.90%	1000	0.8	C
<i>Summary for Southern Marin</i>	8548	8522	100.30%			
Paradise Drive, San Clemente Drive to Prince Royal Drive	604	684	88.30%	2000	0.34	A
Tamalpais Drive, Chapman Drive to Redwood Avenue	507	510	99.40%	800	0.64	B
Magnolia Avenue, Frances Avenue to Estelle Avenue	627	606	103.50%	1600	0.38	A
Bon Air Road, South Eliseo Drive to Sir Francis Drake	672	650	103.40%	800	0.81	D
*East Sir Francis Drake, Larkspur Landing Circle to Andersen Drive	585	900	65.00%	1000	0.9	D
*Sir Francis Drake, Eliseo Drive to La Cuesta Drive	2075	2088	99.40%	2000	1.04	F
*Sir Francis Drake, Bon Air Road to Wolfe Grade	1583	1840	86.00%	2000	0.92	E
Sir Francis Drake, College Avenue to Laurel Avenue	1264	1150	109.90%	2000	0.58	A
Sir Francis Drake/Center Boulevard, West of the "Hub"	2681	3110	86.20%	2400	1.3	F
Sir Francis Drake/Center Boulevard, West of Pastori	1920	1650	116.40%	1600	1.03	F
Sir Francis Drake, East of Oak Manor Drive	769	880	87.40%	800	1.1	F
Redhill Avenue, East of the "Hub"	1705	2300	74.10%	2000	1.15	F
Point San Pedro Road, West of Marina Way	1020	908	112.30%	2000	0.45	A
*North San Pedro Road, East of Civic Center Drive	637	736	86.50%	1600	0.46	A
Manuel Freitas Parkway, Las Gallinas Avenue to Las Pavadas Avenue	423	479	88.30%	2000	0.24	A
*Lucas Valley Road, Highway 101 to Las Gallinas Avenue	706	626	112.80%	1000	0.63	B
*Lucas Valley Road, Miller Creek Road to Mt. Lassen Drive	487	482	101.00%	1000	0.48	A
<i>Summary for Central Marin</i>	10729	11241	95.40%			

Table 16. (continued)

Street and Location	1990 Model Volume	1987/91 Traffic Counts	Model As % of Counts	1987/91 Traffic Capacity	V/C	LOS
Bel Marin Keys Boulevard, Nave Drive to Commercial Boulevard	1167	1558	74.90 %	1600	0.97	E
Ignacio Boulevard, Entrada Drive to San Jose Boulevard	782	627	124.70 %	2000	0.31	A
South Novato Boulevard, Redwood Boulevard to Midway Boulevard	596	521	114.40 %	800	0.65	B
South Novato Boulevard, Rowland Boulevard to Arthur Street	1136	1155	98.40 %	800	1.44	F
Novato Boulevard/Center Road, Diablo Avenue to Tamalpais Avenue	1783	1497	119.10 %	1600	0.94	E
Novato Boulevard, San Miguel Way to San Marin Drive	590	645	91.50 %	800	0.81	D
Grant Avenue, 5th to 7th Streets	724	771	93.90 %	800	0.96	E
DeLong Avenue, Sherman Avenue to Redwood Boulevard	900	1241	72.50 %	2000	0.62	B
Redwood Boulevard, DeLong Avenue to Grant Avenue	483	792	61.00 %	2000	0.4	A
Olive Avenue, Redwood Boulevard to Chase Street	556	530	104.90 %	800	0.66	B
San Marin Drive, Redwood Boulevard to Simmons Lane	723	791	91.40 %	1000	0.79	C
*Atherton Avenue, Highway 101 to Bugeia Lane	393	325	120.90 %	1000	0.33	A
<i>Summary for North Marin</i>	9833	10453	94.10 %			
* denotes Unincorporated Area streets						
Totals for Unincorporated Streets	10452	10954	95.40 %			
Highway 37, Highway 101 to Atherton Avenue	1124	2000	56.20 %	4000	0.5	A
Highway 37, Atherton Avenue to County Line	1171	1700	68.90 %	4000	0.43	A

Table 17. Projected Level of Service and Volume-to-Capacity Ratio on Highway 101

Screenline	1991 Conditions		Buildout	
	Level of Service	Volume to Capacity	Level of Service	Volume to Capacity
Golden Gate Bridge	D	.88	D	.82
Alto Hill	D	.80	C/D	.77
Cal Park Hill	F	1.10	D	.87
Puerto Suello Hill	D	.87	D/E	.94
Pacheco Hill	D	.90	D	.83
Sonoma County Line	F	1.01	C	.57

Notes: The volume-to-capacity ratios for Puerto Suello Hill and the Sonoma County Line reflect the adjustments made to the 1990 model estimates as discussed in the subsection "Calibration of the Transportation Model."

Table 18 shows projected volumes, capacity, volume-to-capacity ratio, and Level of Service for segments of Highway 101 in the model network. For comparative purposes, traffic counts from 1987 and 1991 are shown for the screenlines.

The increased capacity of the road network due to additions of High Occupancy Vehicle (carpool) lanes, auxiliary lanes between several exits, and McInnis Parkway helped improve the Level of Service along Highway 101 at buildout. New carpool and auxiliary lanes between Cal Park Hill and Puerto Suello Hill would accommodate vehicle demand projected by the model (but the segment between Mission and Lincoln Avenues would operate at estimated capacity). Carpool lanes were also added between Highway 37 and the Sonoma County line. The additional capacity allowed the freeway to operate at Level of Service C.

Between North San Pedro Road in San Rafael and Rowland Boulevard in Novato the addition of McInnis Parkway provided a parallel arterial to Highway 101. Vehicles traveling among the traffic zones on the east side of the freeway were assigned to McInnis Parkway in addition to Highway 101. The volume of vehicles using McInnis Parkway reduced the volume of vehicles on Highway 101 by a corresponding amount. The volume of northbound vehicles on McInnis Parkway between Civic Center Drive and Main Entrance Drive at Hamilton AFB varied between 379 and 493 during the peak hour, accounting for less than 7% of the volume on Highway 101. North of Main Entrance Drive however, vehicle volumes on McInnis Parkway ranged between 879 and 1,460. For this stretch, McInnis Parkway carried 25% of all northbound traffic, nearly one lane of freeway capacity.

**Table 18. Projected Traffic Volumes, Volume-to-Capacity Ratio, Level of Service on Highway 101
Total Vehicle Trips, Afternoon Peak Hour, Peak Direction**

Hwy 101 Location	1987/91 Traffic Counts	1991 Capacity	1991 V/C	1991 LOS	Buildout Volume	Buildout Capacity	Buildout V/C	Buildout LOS
*Golden Gate Bridge	6242	7120	0.88	D	5881	7120	0.83	D
*Sausalito Lateral to Spencer Avenue		6374	0.00	N/A	5325	6374	0.84	D
Marin City to State Route 1		9000	0.00	N/A	6186	9000	0.69	C
Richardson Bay Bridge	6223	8000	0.78	D	5695	8000	0.71	C
Seminary Drive to Tiburon Boulevard		8000	0.00	N/A	5446	8000	0.68	C
*Alto Hill	6506	7040	0.92	D	5462	7040	0.78	D
Tamalpais Drive to Lucky Drive	5772	7000	0.82	D	5728	7000	0.82	D
*Cal Park Hill	6130	5580	1.1	F	6524	7440	0.88	D
Interstate 580 to 2nd Street		7000	0.00	N/A	7325	8000	0.92	D
*Mission Avenue to Lincoln Avenue		6560	0.00	N/A	6576	6560	1.00	F
*Puerto Suello Hill	6414	7380	0.87	D	7092	7380	0.96	E
North San Pedro Road to Manuel Freitas		8000	0.00	N/A	6728	8000	0.84	D
Manuel Freitas to Lucas Valley Road		8000	0.00	N/A	6385	8000	0.80	D
Lucas Valley Road to Miller Creek		8000	0.00	N/A	6291	8000	0.79	D
*Pacheco Hill	6706	7440	0.9	D	6236	7440	0.84	D
Alameda Del Prado to Ignacio Boulevard		7000	0.00	N/A	5823	7000	0.83	D
Ignacio Boulevard to Highway 37		7000	0.00	N/A	5443	7000	0.78	D
Highway 37 to Rowland Boulevard	5484	6000	0.91	D	3449	7000	0.49	B
Rowland Boulevard to DeLong Avenue		6000	0.00	N/A	3397	7000	0.49	B
DeLong Avenue to Atherton Avenue		6000	0.00	N/A	2672	7000	0.38	B
Atherton Avenue to Sonoma County Line	4039	4000	1.01	F	2246	5000	0.45	B

* denotes screenlines on Highway 101

Highway 101 "System" Totals				V/C	LOS				V/C	LOS
Screenlines		36037	38560	0.93	E	33441	41420	0.81	D	

Increased use of carpools and transit for commute trips between counties improved the Level of Service on Highway 101 by reducing vehicle demand. Between Marin and San Francisco, the percentage of home-based work trips on transit rose from 16% in 1990 to 25.8% at buildout. Projections for the Sonoma to San Francisco commute between 1990 and buildout showed the percentage of trips made by transit increasing from 19.4% to 32.9%. Two-person carpools were projected to increase from 14% to 18.4%. Three-person carpools were projected to increase from 9.8% to 20.2%. For the Sonoma to Marin commute, the projection was more modest. The percentage of transit trips rose from 1.3% to 4.9%. Two-person carpool trips rose from 24.6% to 28.1% and three-person carpool trips rose from 12% to 17.8%.

E. A COMPARISON WITH THE HIGHWAY 101 CORRIDOR STUDY

The 101 alternative which most closely resembles the land use and transportation systems tested in the buildout alternative is the Rail/Highway alternative with the Composite land use program. In the adopted 101 Corridor Plan, an increase in the capacity of Highway 101 was recommended between Novato and Petaluma, from the four lane freeway tested in the Rail/Highway alternative to four mixed flow and two HOV lanes.

The increased capacity was assumed in the calculation of the V/C ratios shown in Table 19. One important difference between the two sets of traffic projections is that the 101 Corridor Study is based on the morning peak hour conditions while the model run for the Buildout alternative of the Countywide Plan is based on afternoon peak hour conditions. A comparison of the two studies for the operation of Highway 101 at each screenline is shown in Table 19.

The 101 Corridor Study reported that the freeway would be significantly congested at Puerto Suello Hill during the morning peak hour and would operate with limited congestion elsewhere in Marin County. The test of the policies of the Countywide Plan finds that some congestion would occur at Puerto Suello Hill for the afternoon peak hour and that limited congestion would occur elsewhere on Highway 101 in Marin County. The two projections indicate that afternoon traffic flow would be expected to be somewhat heavier than the morning traffic. This would be consistent with the existing traffic conditions on Highway 101. In summary, the two studies provide traffic projections which are generally compatible with one another.

**Table 19. Comparison of Studies: Highway 101 Corridor
and The Countywide Plan**

	Highway 101 Corridor Study Adopted Plan (1)		Marin Countywide Plan Buildout Alternative	
	Southbound Morning Peak		Northbound Afternoon Peak	
	Level of Service	Volume to Capacity	Level of Service	Volume to Capacity
Golden Gate Bridge	C	0.64	D	0.82
Alto Hill	C/D	0.76	C/D	0.77
Cal Park Hill	C	0.70	D	0.87
Puerto Suello Hill	F	1.06	D/E*	0.94*
Pacheco Hill	D	0.89	D	0.83
Sonoma County Line	C	0.69	C*	0.57*

(1) Transportation system capacity as recommended in 101 Corridor Strategic Plan. Auto trips based on the test of Rail/Highway alternative under the Composite land use program.

* Adjusted from model results in proportion to the excess above plus or minus 15% deviation from the 1990 model estimates as compared to actual traffic counts in 1987/91.

F. PROJECTED VOLUMES AND LEVEL OF SERVICE ON SELECTED ARTERIALS

Most of the arterials in Marin County operate at an acceptable Level of Service (D or above). The model estimates combined with estimated arterial segment capacities showed that the following arterial segments were projected to operate at Levels of Service E or F:

- Tiburon Boulevard near Highway 101;
- East Sir Francis Drake Boulevard near Andersen Drive;
- Sir Francis Drake Boulevard in Greenbrae and through the Upper Ross Valley;
- Redhill Avenue near the San Anselmo "Hub";
- Bel Marin Keys Boulevard near Highway 101;
- Most of South Novato Boulevard;

- Novato Boulevard and Grant Avenue west from Redwood Boulevard.

The street improvements recommended in the Countywide Plan include:

- Widening of Shoreline Highway - Highway 101 to Flamingo (engineering studies underway)
- Widening of Tiburon Boulevard - Highway 101 to North Knoll Lane (engineering studies underway)
- Widening of East Sir Francis Drake Boulevard-Highway 101 to Larkspur Ferry (partially funded)
- Constructing McInnis Parkway - Civic Center Drive to Rowland Boulevard (developer funded)
- Widening and extending South Novato Boulevard - Bel Marin Keys Boulevard to Diablo Avenue (partially funded).

When the street improvements recommended in the Countywide Plan are tested against projected traffic demand, most, but not all, areas of severe congestion would be relieved. Even assuming recommended street improvements, the following arterial segments would continue to operate at Levels of Service E or F:

- East Sir Francis Drake Boulevard near Andersen Drive;
- Sir Francis Drake Boulevard in Greenbrae and through the Upper Ross Valley;
- Redhill Avenue near the San Anselmo "Hub";
- Novato Boulevard and Grant Avenue west from Redwood Boulevard.

In addition, the proposed McInnis Parkway would operate at service level E or F if it were constructed with just one lane in each direction (the evaluation in Table 21 included two lanes in each direction in the Novato area).

The low Level of Service on East Sir Francis Drake Boulevard could be corrected with a traffic signal and an additional lane near the west gate of San Quentin Prison. Additional roadway lanes in several locations are needed to relieve service level F conditions along Sir Francis Drake and Novato Boulevards. However, this kind of street widening has been rejected in the past due to the severe impact it would have on the adjacent properties and on the natural environment.

Traffic signal coordination is planned in the Upper Ross Valley. This will help reduce, but not completely solve, the low service level problems in this area. Novato may ultimately be able to satisfy environmental concerns and widen Novato Boulevard from Diablo to Seventh Street, which would solve the service level problem on that street and on Grant Avenue.

Table 20 shows the projected traffic volumes, capacity, volume-to-capacity ratio and Level of Service for selected arterials. For comparison purposes, it also shows what the volume-to-capacity ratio and Level of Service would be at buildout if no improvements were made beyond those existing in 1991. This information appears in the last three columns of the table.

**Table 20. Projected Traffic Volumes, Volume-to-Capacity Ratio,
Level of Service on Arterials, Buildout and 1991 Street Systems
(Afternoon Peak Hour, Peak Direction)**

Street and Location	Buildout		Buildout With Improvements			1991 Street System		
	Model Volume	Adjust Factor*	Capacity	V/C	LOS	Capacity	V/C	LOS
Bridgeway Boulevard, Spring Street to Nevada Street	892		2000	0.45	A	2000	0.45	A
Shoreline Highway, Tennessee Valley Road to Almonte Boulevard	1143		1600	0.71	C	1600	0.71	C
Almonte Boulevard, Shoreline Highway to Miller Avenue	538		800	0.67	B	800	0.67	B
Miller Avenue, Camino Alto to Montford Avenue	1390		2000	0.70	B	2000	0.70	B
Blithedale Avenue, Lomita Drive to Camino Alto	2189		3000	0.73	C	3000	0.73	C
Blithedale Avenue, Elm Avenue to Carmelita Avenue	644		800	0.81	D	800	0.81	D
Tiburon Boulevard, Highway 101 to Frontage Road	2008		3000	0.67	B	2000	1.00	F
Tiburon Boulevard, Rock Hill Drive to San Rafael Avenue	840		1000	0.84	D	1000	0.84	D
Paradise Drive, San Clemente Drive to Prince Royal Drive	1040		2000	0.52	A	2000	0.52	A
Tamalpais Drive, Chapman Drive to Redwood Avenue	580		800	0.73	C	800	0.73	C
Magnolia Avenue, Frances Avenue to Estelle Avenue	715		1600	0.45	A	1600	0.45	A
Bon Air Road, South Eliseo Drive to Sir Francis Drake	555		800	0.69	B	800	0.69	B
East Sir Francis Drake, Larkspur Landing Circle to Andersen Drive	883	1.31	1000	1.16	F	1000	1.16	F
Sir Francis Drake, Eliseo Drive to La Cuesta Drive	2090		2000	1.05	F	2000	1.05	F
Sir Francis Drake, Bon Air Road to Wolfe Grade	1100		2000	0.55	A	2000	0.55	A
Sir Francis Drake, College Avenue to Laurel Avenue	1398		2000	0.70	B	2000	0.70	B
Sir Francis Drake/Center Boulevard, West of the Hub	2844		2400	1.19	F	2400	1.19	F
Sir Francis Drake/Center Boulevard, West of Pastori	1956		1600	1.22	F	1600	1.22	F
Sir Francis Drake, East of Oak Manor Drive	896		800	1.12	F	800	1.12	F
Redhill Avenue, East of the Hub	1944	1.15	2000	1.12	F	2000	1.12	F
Point San Pedro Road, West of Marina Way	1024		2000	0.51	A	2000	0.51	A

Table 20 (continued)

Street and Location	Buildout		Buildout With Improvements			1991 Street System		
	Model Volume	Adjust Factor*	Capacity	V/C	LOS	Capacity	V/C	LOS
North San Pedro Road, East of Civic Center Drive	849		1600	0.53	A	1600	0.53	A
Manuel Freitas Parkway, Las Gallinas Avenue to Las Pavadas Avenue	449		2000	0.22	A	2000	0.22	A
Lucas Valley Road, Highway 101 to Las Gallinas Avenue	755		1000	0.76	C	1000	0.76	C
Lucas Valley Road, Miller Creek Road to Mt. Lassen Drive	645		1000	0.65	B	1000	0.65	B
McInnis Drive, Smith Ranch Road to St. Vincents Drive	790		800	0.99	E			N/A
Bel Marin Keys Boulevard, Nave Drive to Commercial Boulevard	939	1.13	2000	0.53	A	1600	1.14	F
Ignacio Boulevard, Entrada Drive to San Jose Boulevard	1020		2000	0.51	A	2000	0.51	A
South Novato Boulevard, Redwood Boulevard to Midway Boulevard	861		2000	0.43	A	800	1.08	F
South Novato Boulevard, Rowland Boulevard to Arthur Street	1322		2000	0.66	B	800	1.65	F
Novato Boulevard/Center Road, Diablo Avenue to Tamalpais Avenue	2104		1600	1.32	F	1600	1.32	F
Novato Boulevard, San Miguel Way to San Marin Drive	696		800	0.87	D	800	0.87	D
Grant Avenue, 5th to 7th Streets	811		800	1.01	F	800	1.01	F
DeLong Avenue, Sherman Avenue to Redwood Boulevard	1472	1.17	2000	0.86	D	2000	0.86	D
Redwood Boulevard, Delong Avenue to Grant Avenue	1110	1.39	2000	0.77	C	2000	0.77	C
Olive Avenue, Redwood Boulevard to Chase Street	655		800	0.82	D	800	0.82	D
San Marin Drive, Redwood Boulevard to Simmons Lane	776		1000	0.78	C	1000	0.78	C
Atherton Avenue, Highway 101 to Bugeia Lane	641		1000	0.64	B	1000	0.64	B
McInnis Drive, Hamilton Drive to Bel Marin Keys Boulevard	1460		2000	0.73	C			N/A
McInnis Drive, Bel Marin Keys Boulevard to Highway 37	1351		2000	0.68	B			N/A

* Factor to adjust model volumes based on calibration of 1990 model run.

Highway 37, Highway 101 to Atherton Avenue	2499		4000	0.62	B	4000	0.62	B
Highway 37, Atherton Avenue to County Line	2068		4000	0.52	A	4000	0.52	A

U.C. BERKELEY LIBRARIES



C124906542

